A PROCESS FOR METALWORKING FLUID FROM HEAVY ALKYLATE

Field of Invention:

The present invention relates to a process for metalworking fluids from heavy alkylate. More particularly this invention relates to composition of metalworking fluid and process for its preparation based on heavy alkyl benzenes having 22 to 26 carbon atoms to replace mineral oil.

Background and Prior Art References:

Traditionally, the mineral oils and petroleum sulfonates have been the basic source of metalworking fluid formulations. The petroleum based lubricating oils and sulfonates are hydrocarbons of varying composition consisting of naphthenes, paraffins and aromatics. The sulfonates on the other hand formed by sulfonation of aromatic components in these lubricating oil streams act as oil/water emulsifiers. Besides these various additives, which are primarily chemicals of defined composition or structure, are added to the soluble oils to improve the physico-chemical properties and performance of metalworking fluids.

Petroleum based soluble oils, generally suffer from many disadvantages such as higher toxicity to the environment, poor biodegradability and ever-changing characteristics with changes in crude oil composition. The other types of lubricants known as synthetic lubricants are designed for use in extreme conditions of temperature, pressure, radiation or chemical environment and have excellent lubricity and thermal stability. The synthetic lubricants are

relatively costly as compared to petroleum based lubricants. Poly-glycols, polybutenes, dibasic acid esters, fluoropolymers, polyol esters, phosphate esters, silicones, poly-alpha olefins etc. are commonly used synthetic lubricants for various applications. Some of the synthetics are also toxic to environment and are not readily biodegradable. Similar disadvantages are found with Petroleum sulfonates which are by-products of sulfonation of lubricating oils also suffer from inconsistent emulsification and compatibility characteristics due to everchanging composition of the lubricating oils.

Keeping in the view the environmental concerns and improved performance, consistency in structural and performance characteristics, there is a need to develop alternative lubricant and emulsifier component, for metalworking fluids, which are less toxic and low cost which show equivalent or improved performance to mineral oil or synthetic lubricant based metalworking fluids.

The use of Heavy alkyl benzene as lubricant is very limited. Recently, the Heavy Alkyl Benzene alkaline earth metal sulfonates are in use as detergent-dispersant-anti rust additive in various types of lubricants.

Reference may be made to M/S Petresa, Madrid, Spain, (www.petresa.es) wherein they are marketing heavy alkylate under the brand name of 'PETRENE' to be use as thermal fluid, transformer oil, refrigerating oil, sulfonation feedstock and lubricating greases but not for metalworking fluids.

Reference may be made to M/s Chevron, U.S.A. Inc., (San Ramon, CA) has US patent 6,187,981 "Process for producing arylalkanes and arylalkanes sulfonates, compositions produced therefrom, and uses thereof". Wherein this invention is a process for producing aryl-alkanes. This invention also provides process that to produce modified alkylbenzene sulfonates, which can be used as detergents.

Chevron, U.S.A. Inc., (San Ramon, CA) has US patent 6,392,109 "Synthesis of alkylbenzenes and synlubes from Fischer-Tropsch products" which is for an integrated process for producing alkylbenzenes, sulfonated alkylbenzenes and/or alkylcyclohexanes from syngas and used as detergents and/or dispersants.

In view of the growing concern about the environment, there is a need for less-toxic lubricant component for metalworking soluble oil based on Heavy alkyl benzene, which is a new application of the heavy alkylate. It will not only reduce the toxicity of soluble oil but also will be more cost effective than mineral oil because of improved and consistent performance because both the mineral oil component and the sulfonates made from these alkylates can be tailored to obtain a high performance product of consistent quality. It is an additional benefit to the alkylate industry.

Objects of the Invention:

The main object of the present invention is to provide a process for metalworking fluids from heavy alkylate.

Another object of the present invention is to provide heavy alkylate based less toxic lubricant component metalworking fluids.

Still another objects of the present invention is to provide a new application to the by-product heavy alkylate.

Yet another object of the present invention is to provide new composition of metalworking fluid for the benefit of metalworking and alkylate manufacturing industries.

Summary of Invention:

The present invention relates to a process for metalworking fluids from heavy alkylate. More particularly this invention relates to composition of metalworking fluid and process for its preparation based on heavy alkyl benzenes having 22 to 26 carbon atoms to replace mineral oil.

The speed of machining could be greatly increased if the cutting surface is kept cool and lubricated. Water can be regarded as the first cutting fluid because of its high specific and latent heats to give it unique potential cooling power and also it is available everywhere at low cost. However, due to poor wetting efficiency, water alone can't cool the metal surface with its full ability. Another serious disadvantage is the formation of rust on iron and steel surfaces. Modern development has led to the introduction of advanced water-oil emulsion incorporating special chemicals, which considerably improve its wettability, lubrication, high cooling power, rust inhibiting and detergency properties. These concentrates and their

emulsions in water are known as 'Soluble Oil'. They are ideal for general machining process where Cooling, Lubrication, Cleaning and extreme pressure characteristics are essential requirements.

Detailed description:

Accordingly the present invention provides a process for metalworking fluid from heavy alkylate, which comprises ;

(a) residual fraction having C20 to C22 carbon atom of detergent class Alkyl Benzene in the concentration range of 50 to 90 weight percent of the metal working fluid , (b) at least one emulsifier in the range of 10 to 40 weight percent of the metalworking fluid, (c) at least one lubricity booster component in the concentration range of 2-10 percent of metal working fluid, (d) an antioxidant component is in the concentration range of 50-500 ppm, (e) a fungicide component in the concentration range of 50-500 ppm, (f) an extreme pressure additive component in the concentration range of 50-500 ppm (g) an antirust component in the concentration range of 50-500 ppm, (h) a co-surfactant component in the range of 1-10 weight percent of metal working fluid, (i) a coupling agent in the range of 0.5 to 10 weight percent of metal working fluid, (j) alkali component in the range of 8-10 weight percent of metal working fluid.

Heavy alkyl benzene is produced as by-products during the preparation of linear alkyl benzene sulfonates for detergent industry. The alkylation reaction of C_{10}-C_{14} olefin with benzene results in side reactions to give dialkyl benzenes and alkylated condensed ring derivatives. These products are generally in the range of 5 to 15 percent of the total alkylates

depending upon the reaction conditions and purity of reactants employed. Heavy alkyl benzene consists of substituted benzenes and Naphthalenes as determined by HPLC, UV, IR and RI analysis given in Table - 1. The typical properties such as density, kinetic viscosity, viscosity index, refractive index, pour point, molecular weight and distillation characteristics were given in Table - 2. No poly-aromatics or olefinic compounds are present in the heavy alkylates. These heavy alkylates have been acquired from the Indian market.

Table – 1

Typical Relative Content of Alkyl Benzenes and Alkyl Napthalenes

Components	HAB - I		HAB – II	
	IR	UV 254	IR	UV 254
Alkyl Benzenes % by wt.	84 ± 2	84±2	93±2	90±2
Alkyl Napthalenes % by wt.	15±2	16±2	7±2	10±2

Table - 2

Typical Characteristics of Heavy Alkyl Benzenes

Characteristics	**HAB – I**	**HAB – II**
Density at 15°C	0.8839	0.8813
K. Viscosity Cst at 40°C	28.95	26.93
K. Viscosity Cst at 100°C	4.50	4.31
Viscosity Index	37	32
Pour Point °C	(-) 27	(-) 25
Molecular wt.	365±5	361±5
Distillation range °C (ASTM D1160)	225 - 440	226 – 515
Refractive index at 20°C	1.4946	1.4916

In an embodiment of the present invention the oil component is a heavy alkyl benzene having C20 – C22 carbon number, a heavy fraction, by-product, separated from detergent class alkyl benzene during manufacture.

In another embodiment of the present invention the concentration of heavy alkyl benzene component is in between 50 to 90 weight percent of the metalworking fluid.

In yet another embodiment of the present invention the emulsifier component is a heavy alkylate sodium sulfonates, sodium carboxylate, sodium oleate, Triethalonoamine oleate, Diethalonoamine oleate or Dodecyl Toluene sodium sulfonate or mixtures thereof.

In still another embodiment of the present invention the concentration of emulsifier component is in between 10 to 40 weight percent of the metalworking fluid.

In still another embodiment of the present invention the vegetable oil component for lubricity booster is a karanja oil, neem oil, rice-bran oil, castor oil or mixtures thereof.

In still another embodiment of the present invention the concentration of vegetable oil component for lubricity boost is in between 2 to 10 weight percent of the metalworking fluid.

In still another embodiment of the present invention the antioxidant component is an alkyl phenol or aromatic amine or substituted alkyl phenol selected from 2,6-ditertiary butyl phenol, 2,6-ditertiary p-cresol, Diphenylamine, Tertiary butyl phenol amino tetrazole and 2,6-dioctyl phenylene diamine.

In still another embodiment of the present invention the concentration of antioxidant component is in between 50 to 500 ppm.

In still another embodiment of the present invention the fungicide component is a phenol or phenolic acid selected from o-cresol, phenol, m-cresol and cresylic acid.

In still another embodiment of the present invention the concentration of fungicide component is in between 50 to 500 ppm.

In still another embodiment of the present invention the extreme pressure additive component is an organic sulfide or phosphosulfurized metal salt selected from dibenzyl disulphide, sulfurized vegetable oil, phosphosulfurized decyl oleate molybdate and phosphothio pentadecyl phenol molybdate.

In still another embodiment of the present invention the concentration of extreme pressure additive component is in between 50 to 500 ppm.

In still another embodiment of the present invention the anti-rust component is a triazole or sulfonate selected from 1H-benzotriazole, ditertiary butylated 1H-Benzotriazole, calcium petroleum sulfonate and calcium heavy alkylate sulfonate.

In still another embodiment of the present invention the concentration of ant-rust component is in between 50 to 500 ppm.

In still another embodiment of the present invention the co-surfactant component is a alcohol selected from isopropanol, n-butanol, iso-butanol, iso-amyl alcohol, 2 ethyl hexanol, mono & poly glycol such as di ethylene glycol and tri ethylene glycol.

In still another embodiment of the present invention the concentration of co-surfactant component is in between 1 to 10 weight percent of the metalworking fluid.

In still another embodiment of the present invention the coupling agent component is a sulfonates (molecular weight less than 350) selected from ligno sulfonate, petroleum sulfonate, sodium dodecyl benzene sulfonate and sodium lauryl sulfate.

In still another embodiment of the present invention the concentration of coupling agent component is in between 0.5 to 10 weight percent of the metalworking fluid.

In still another embodiment of the present invention the alkali component is a alkali and alkaline earth metal salt selected from sodium carbonate, sodium hydrogen carbonate, calcium carbonate, calcium oxide.

In still another embodiment of the present invention the concentration of alkali component is in between 0.5 to 8 weight percent of the metalworking fluid.

In still another embodiment of the present invention the composition is suitable for use as metal working fluid and general emulsion as admixture with water in concentration ranging from 20 to 80 weight percent.

After the addition of all the components the mixture is homogenized. Then it is conditioned by keeping it at room temperature for 24 hours undisturbed. Dilute emulsion of the soluble oil

may be prepared by mixing the concentrate in water with vigorous agitation for 1 to 5 minutes in the ratio of 20:80 to 80:20 wt% as per requirements of the metal work and nature of metal.

It will be apparent from the foregoing that the present invention provides non-toxic lubricant component by using heavy alkyl benzene and useful for making formulation for metalworking soluble oil. This invention further provides a suitable new application for heavy alkyl benzene as a by-product to increase its value.

The invention will now be further described by the following examples, which are given only for the purpose of illustration and not intended to limit the scope of the invention. Although the invention has been described in conjunction with examples and by reference to the embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in art in light of the foregoing description, accordingly it is intended in the invention to embrace these and all such alternatives, variations and modifications as may fall with in the sprit and scope of the appended claims.

Example – 1

After removal of insoluble matter, the heavy alkyl benzene in 65 weight percent was mixed with heavy alkyl benzene sodium sulfonate in 10 weight percent and karanja oil 5 weight percent of metalworking fluid as component for lubricity. The mixture was homogenized at 30 to 100°C for one hour with stirring to obtain clear solution. Then ligno sulfonate as coupling agent in concentration of 5 weight percent of the fluid, 2,6, ditertiary butyl 4 methyl phenol 100 ppm as antioxidant, cresylic acid 100 ppm as fungicide, dibenzyl disulfide 100 ppm as extreme pressure additive, 1H-benzotriazole 100 ppm as antirust additive and

isobutanol 5 weight percent of the metalworking fluid as co-surfactant were added. The mixture was further homogenized for 30 minutes. Water was added to make-up quantity to 1 kg and further homogenized for 30 minutes. The pH of the solution was adjusted to 7 – 9 by adding sodium carbonate. The solution was cooled down to room temperature with stirring. The final composition (HA – 1) is given in Table – 3. The neat soluble oil then mixed with water in 60 to 90 wt % ratio and shaken to produce oil-water emulsion. This emulsion was evaluated for its different characteristics, which are given in Table – 4 and 5. It was found that the characteristics of the neat and emulsion are at par with the specifications.

Table – 3

TYPICAL COMPOSITION OF SOLUBLE OIL

SN	Constituents	HA-I	HA-II	HA-III
1	Heavy Alkyl Benzene %	65	60	75
2	Emulsifier %	10	15	10
3	Additives ppm	400	350	450
4	Co-surfactant %	6	5	7
5	Lubricity Additive	5	5	5
6	Coupling agent %	4	6	3
7	Alkali %	1 approx.	1 approx.	1 approx.
8	Water %	5 - 10 approx.	5 - 10 approx.	5 - 10 approx.

Example – 2

The procedure of Example 1 was repeated with alkylate 60 weight percent except that Dodecyl Toluene Sodium Sulfonate 15 weight percent was taken as emulsifier in place of Heavy Alkyl Benzene Sodium Sulfonate, neem oil as component for lubricity in place of karanja oil, 2,6-dioctyl phenylene diamine as antioxidant in place of 2,6,-ditertiary butyl 4-methyl phenol, m-cresol as fungicide in place of cresylic acid, phosphothio pentadecyl phenol as extreme pressure additive in place of dibenzyl disulphide. The final composition (HA – I1) is given in Table – 3 and evaluation in Table-4 & 5.

Example – 3

The procedure of Example 1 was repeated with alkylate 75 weight percent except that Sodium Oleate 10 weight percent was taken as emulsifier in place of Heavy Alkyl Benzene Sodium Sulfonate. The final composition (HA – II1) is given in Table – 3 and evaluation in Table-4 & 5. It was found that the characteristics of the neat and emulsion are as per requirement.

Table – 4

TYPICAL CHARACTERISTICS OF SOLUBLE OIL

SN	**Formulation**	**K.Viscosity 40°C - Cst**	**Total Acid No- mg KOH**	**Ash %**	**Clarity**	**Flash Point-°C**	**Reactable Sulfur at 100°C**
1	HA-I	23.3	NIL	0.009	Clear	210	NIL
2	HA-II	26.2	NIL	0.008	Clear	215	NIL
3	HA-III	24.5	NIL	0.006	Clear	213	NIL

Table – 5

TYPICAL EVALUATION OF SOLUBLE OIL

SN	**Formulation**	Copper corrosion	Deposit test	Emulsion stability	Cast iron rust	Saponification value – mg KOH	Low temp Stability	Frothing Test
1	HA- I	< 1	NIL	Pass	Pass	4.8	Pass	Pass
2	HA- II	< 1	NIL	Pass	Pass	4.5	Pass	Pass
3	HA- III	< 1	NIL	Pass	Pass	4.6	Pass	Pass

What is now claimed: